ABSTRACT

Methods of making paper or paperboard are described. According to one method, fibrous cationic colloidal alumina microparticles and a polymer are introduced to a papermaking pulp to form a treated pulp having improved retention properties. The fibrous cationic colloidal alumina microparticles are preferably a fibrous cationic acetate salt of boehmite alumina having a zeta potential of greater than about 25 and a weight ratio of alumina to acetate of less than about 4. The polymer can be a cationic polymer, a nonionic polymer, an amphoteric polymer under cationic conditions, or combinations thereof. The pulp may also be treated with at least one coagulant, at least one flocculant, at least one cationic starch, at least one cellulytic enzyme, and/or other conventional papermaking pulp additives. The resulting pulp is formed into a sheet of pulp and then drained to form a paper or paperboard. Other papermaking processes are also described as is a papermaking apparatus for carrying out the methods. Paper and paperboard containing dried pulp that has been treated with fibrous cationic colloidal alumina microparticles and polymer are also described.